WHAT IS CLAIMED IS:

1. A grating-coupled waveguide sensor comprising:

a substrate;

a diffraction grating; and

a waveguide film, wherein a waveguide formed by said diffraction grating and said waveguide film receives a polarization-modulated light beam and outputs an amplitude modulated light beam that is analyzed by an optical interrogation system which demodulates the amplitude modulated light beam by responding to signals at a modulation frequency of the polarization-modulated light beam and ignoring noise affecting the signals outside the modulation frequency to determine whether a biological substance is located in a sensing region above said waveguide film.

2. The grating-coupled waveguide sensor of Claim 1, wherein said biological substance is a cell, molecule, protein, drug, chemical compound, nucleic acid, peptide or carbohydrate.

3. The grating-coupled waveguide sensor of Claim 1, wherein said optical interrogation system utilizes an angular scanning approach to scan the polarization-modulated light beam to enable the detection of a resonant angle which indicates whether the biological substance is located in the sensing region above said waveguide film.

4. The grating-coupled waveguide sensor of Claim 1, wherein said optical interrogation system utilizes an angular scanning approach to scan the amplitude modulated light beam to enable the detection of a resonant angle which indicates whether the biological substance is located in the sensing region above said waveguide film.

5. The grating-coupled waveguide sensor of Claim 1, wherein said optical interrogation system utilizes a wavelength scanning approach to scan the polarization-modulated light beam to enable the detection of a resonant wavelength which indicates whether the biological substance is located in the sensing region above said waveguide film.

6. The grating-coupled waveguide sensor of Claim 1, wherein said optical interrogation system utilizes a wavelength scanning approach to scan the amplitude modulated light beam to enable the detection of a resonant wavelength which indicates whether the biological substance is located in the sensing region above said waveguide film.

7. An optical interrogation system for interrogating a grating-coupled waveguide sensor, said optical interrogation system comprising:

a light source capable of outputting a polarized light beam;

a polarization modulator capable of modulating the polarized light beam and outputting a polarization-modulated light beam;

said grating-coupled waveguide sensor capable of receiving the polarization-modulated light beam and converting the polarization-modulated light beam into an amplitude modulated light beam;

a detection system capable of receiving the amplitude modulated light beam and further capable of demodulating the received amplitude modulated light beam by responding to signals at a modulation frequency of the polarization-modulated light beam and ignoring noise affecting the signals outside the modulation frequency to detect a resonant condition which corresponds to a predetermined refractive index that indicates whether a biological substance is located in a sensing region of said grating-based waveguide sensor.

8. The optical interrogation system of Claim 7, wherein said biological substance is a cell, molecule, protein, drug, chemical compound, nucleic acid, peptide or carbohydrate.

9. The optical interrogation system of Claim 7, wherein said polarization modulator is a photoelastic modulator.

10. The optical interrogation system of Claim 7, wherein said polarization modulator is a photorefractive modulator.

11. The optical interrogation system of Claim 7, wherein said polarization modulator is a liquid crystal modulator.

12. The optical interrogation system of Claim 7, wherein said grating-coupled waveguide sensor is located within a microplate.

13. The optical interrogation system of Claim 7, wherein said detection system includes a photodiode capable of receiving the amplitude modulated light beam and converting the amplitude modulated light beam into an electrical signal that is demodulated by a lock-in amplifier.

14. The optical interrogation system of Claim 13, wherein phase information within said demodulated electrical signal is used to identify the resonant condition which indicates whether the biological substance is located in the sensing region of said grating-coupled waveguide sensor.

15. The optical interrogation system of Claim 13, wherein amplitude information within said demodulated electrical signal is used to identify the resonant condition which indicates whether the biological substance is located in the sensing region of said grating-coupled waveguide sensor.

16. The optical interrogation system of Claim 7, further comprising:

an acousto-optic modulator capable of receiving the polarization-modulated light beam from said polarization modulator and further capable of scanning the angle of the polarization-modulated light beam;

a lens capable of receiving the polarization-modulated light beam from said acousto-optic modulator and further capable of directing the polarization-modulated light beam into said grating-coupled waveguide sensor; and

said detection system including:

a detector capable of receiving the amplitude modulated light beam from said grating-coupled waveguide sensor and further capable of converting the amplitude modulated light beam into an electrical signal; and

a lock-in amplifier capable of receiving the electrical signal from said detector and further capable of demodulating the electrical signal to detect the resonant condition which indicates whether the biological substance is located in the sensing region of said grating-based waveguide sensor; and

a function generator capable of synchronizing said polarization modulator and said lock-in amplifier.

17. The optical interrogation system of Claim 7, further comprising:

a lens capable of receiving the polarization-modulated light beam from said polarization modulator and further capable of directing the polarization-modulated light beam into said grating-coupled waveguide sensor; and

said detection system including:

a scanning pinhole plate capable of receiving the amplitude modulated light beam from said grating-coupled waveguide sensor and further capable of scanning the angle of amplitude modulated light beam;

a detector capable of receiving the amplitude modulated light beam from said scanning pinhole plate and further capable of converting the amplitude modulated light beam into an electrical signal; and

a lock-in amplifier capable of receiving the electrical signal from said detector and further capable of demodulating the electrical signal to detect the resonant condition which indicates whether the biological substance is located in the sensing region of said grating-based waveguide sensor; and

a function generator capable of synchronizing said polarization modulator and said lock-in amplifier.

18. The optical interrogation system of Claim 7, further comprising:

a tunable filter capable of receiving the broadband polarization-modulated light beam from said polarization modulator and further capable of scanning the wavelength of the polarization-modulated light beam;

a beam splitter capable of receiving the polarization-modulated light beam from said tunable filter and further capable of directing the polarization-modulated light beam into said grating-coupled waveguide sensor; and

said detection system including:

a detector capable of receiving the amplitude modulated light beam from said grating-coupled waveguide sensor and further capable of converting the amplitude modulated light beam into an electrical signal; and

a lock-in amplifier capable of receiving the electrical signal from said detector and further capable of demodulating the electrical signal to detect the resonant condition which indicates whether the biological substance is located in the sensing region of said grating-based waveguide sensor; and

a function generator capable of synchronizing said polarization modulator and said lock-in amplifier.

19. The optical interrogation system of Claim 7, further comprising:

a beam splitter capable of receiving the polarization-modulated light beam from said polarization modulator and further capable of directing the polarization-modulated light beam into said grating-coupled waveguide sensor; and

said detection system including:

a scanning filter capable of receiving the amplitude modulated light beam from said grating-coupled waveguide sensor and further capable of scanning the wavelength of the amplitude modulated light beam;

a detector capable of receiving the amplitude modulated light beam from said scanning filter and further capable of converting the amplitude modulated light beam into an electrical signal; and

a lock-in amplifier capable of receiving the electrical signal from said detector and further capable of demodulating the electrical signal to detect the resonant condition which indicates whether the biological substance is located in the sensing region of said grating-based waveguide sensor; and

a function generator capable of synchronizing said polarization modulator and said lock-in amplifier.

20. A method for interrogating one or more grating-coupled waveguide sensors, said method comprising the steps of:

directing a polarization-modulated light beam into each grating-coupled waveguide sensor;

receiving an amplitude modulated light beam from each grating-coupled waveguide sensor; and

analyzing each received amplitude modulated light beam to detect a resonant condition which corresponds to a superstrate refractive index that

indicates whether a biological substance is located in a sensing region of the respective grating-coupled waveguide sensor.

21. The method of Claim 20, wherein said biological substance is a cell, molecule, protein, drug, chemical compound, nucleic acid, peptide or carbohydrate.

22. The method of Claim 20, wherein said analyzing step further includes:

converting each received amplitude modulated light beam into an electrical signal; and

demodulating each electrical signal to identify the resonant condition which indicates whether the biological substance is located in the sensing region of the respective grating-coupled waveguide sensor.

23. The method of Claim 22, wherein phase information within said demodulated electrical signal is used to identify the resonant condition which indicates whether the biological substance is located in the sensing region of the respective grating-coupled waveguide sensor.

24. The method of Claim 22, wherein amplitude information within said demodulated electrical signal is used to identify the resonant condition which indicates whether the biological substance is located in the sensing region of the respective grating-coupled waveguide sensor.

25. The method of Claim 20, wherein said analyzing step utilizes an angular scanning approach to scan the polarization-modulated light beam to enable the detection of a resonant angle which indicates whether the biological substance is located in the sensing region of the respective grating-coupled waveguide sensor.

26. The method of Claim 20, wherein said analyzing step utilizes an angular scanning approach to scan the amplitude modulated light beam to enable the detection of a resonant angle which indicates whether the biological substance is located in the sensing region of the respective grating-coupled waveguide sensor.

27. The method of Claim 20, wherein said analyzing step utilizes a wavelength scanning approach to scan the polarization-modulated light beam to enable the detection of a resonant wavelength which indicates whether the biological substance is located in the sensing region of the respective grating-coupled waveguide sensor.

28. The method of Claim 20, wherein said analyzing step utilizes a wavelength scanning approach to scan the amplitude modulated light beam to enable the detection of a resonant wavelength which indicates whether the biological substance is located in the sensing region of the respective grating-coupled waveguide sensor

29. The method of Claim 20, wherein said grating-coupled waveguide sensor is located within a microplate.

30. A microplate comprising:

a frame including a plurality of wells formed therein, each well incorporating a grating-based waveguide that includes:

a substrate;

a diffraction grating;

a waveguide film;

wherein said substrate receives a polarization-modulated light beam that is converted into an amplitude modulated light beam after the polarization-modulated light beam interacts with said diffraction grating, said waveguide film and a sensing region of said waveguide film; and

wherein said substrate outputs the amplitude modulated light beam that is received by an optical interrogation system that demodulates the amplitude modulated light beam by responding to signals at a modulation frequency of the polarization-modulated light beam and ignoring noise affecting the signals outside the modulation frequency to

determine whether a biological substance is located in the sensing region of said waveguide film.

31. The microplate of Claim 30, wherein said biological substance is a cell, molecule, protein, drug, chemical compound, nucleic acid, peptide or carbohydrate.

32. The microplate of Claim 30, wherein said optical interrogation system utilizes an angular scanning approach to scan the polarization-modulated light beam to enable the detection of a resonant angle which indicates whether the biological substance is located in the sensing region of said waveguide film.

33. The microplate of Claim 30, wherein said optical interrogation system utilizes an angular scanning approach to scan the amplitude modulated light beam to enable the detection of a resonant angle which indicates whether the biological substance is located in the sensing region of said waveguide film.

34. The microplate of Claim 30, wherein said optical interrogation system utilizes a wavelength scanning approach to scan the polarization-modulated light beam to enable the detection of a resonant wavelength which indicates whether the biological substance is located in the sensing region of said waveguide film.

35. The microplate of Claim 30, wherein said optical interrogation system utilizes a wavelength scanning approach to scan the amplitude modulated light beam to enable the detection of a resonant wavelength which indicates whether the biological substance is located in the sensing region of said waveguide film.

36. The microplate of Claim 30, wherein said optical interrogation system utilizes a diffractive optic to generate the multiple polarization-modulated light beams that are directed towards the wells.